Characterisation of Weathered and Granitised Fractured Bedrock Aquifer Based on WISH and FC Methods

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Abstract

The hydrodynamic properties of the weathered-fractured layer of a hard-rock in a granitic terrain are characterized using hydraulic tests at different scales in Pallisa District. The WISH (Windows Interpretation System for Hydrogeologists) and FC (Flow Characteristic) methods used required short-duration pumping cycles on an unconfined aquifer with differing seasonal water-table fluctuations. The interpretations of several pumping tests at a site in Pallisa District under various initial conditions provide information on the change in hydrodynamic parameters in relation to water-table level. The transmissivity linearly decreases compared with the available water level, suggesting a non-homogeneous distribution of hydraulic conductivity with depth. The hydraulic conductivity is estimated from the slope of this linear relationship. The extrapolation of the relationship between transmissivity and water level provides an estimate of the aquifer thickness that is in good agreement with geophysical investigations. The hydraulically active part of the aquifer is located in both the shallow weathered and the underlying densely granitic fractured zones of the crystalline basement. It appears that the extension of the most conductive part of the weathered-fractured layer is limited down to 50 metres depth. However, no significant relationship is found between the aquifer storage coefficient and water level. These methods contribute to filling the methodological gap between single pumping test and hydraulic tomography, by providing information on the variation of the regional transmissivity according to depth. They can be applied to any unconfined and semi-confined aquifers that experience seasonal water-table fluctuations and short pumping cycles.

Keywords: Groundwater hydraulics, Pallisa district, Crystalline rocks, Granitic fractured rocks, Pumping tests